#16/Appeal Brief
5-7-02
Hawkins

Our Reference: VWS-458-A

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Peter J. Danish, et al.
Serial Number:	09/467,530
Filing Date:	December 20, 1999
Examiner/Art Group Unit:	Perez, G./2834
Title:	WINDSHIELD WIPER MOTOR WITH MOLDED SLEEVE AND THRUST ELEMENTS

APPEAL BRIEF

Assistant Commissioner of Patents
Washington, D.C. 20231

Sir:

Please enter the following Appeal Brief in the appeal filed on February 22, 2002.

REAL PARTY IN INTEREST

The real party in interest is Valeo Electrical Systems by Assignment recorded on Reel 010718, and Frame 0716.

RELATED APPEALS AND INTERFERENCES

There are no other related appeals and interferences.

STATUS OF CLAIMS

Claims 1-7, 15-18, and 25-28 were subject to final rejection in the Office Action dated September 24, 2001. Claims 8-14 and 19-24 are currently withdrawn from consideration subject to decision on petition.

STATUS OF AMENDMENTS

An After Final Amendment was filed on December 21, 2001 and refused entry in the Advisory Action dated January 23, 2002. A petition from requirement of restriction was filed on November 20, 2002 and no response has been

received yet indicating a decision on that petition. Another Amendment After Final Rejection accompanies this Appeal Brief amending claims 1, 6, 8, 12-15, 17-19, 23, 25, and 27 to remove the rejection under 35 U.S.C. §112, first and second paragraph.

SUMMARY OF THE INVENTION

A motor/gear drive includes a motor shaft 10 having a worm gear 14 carried thereon and a tip end portion 16 of the shaft 10 terminating in an end wall 18. (Page 7, lines 20-27). The motor/gear drive includes a housing 12 having a bore 40 coaxial with the output shaft 10. (Page 9, lines 26-31).

A plastic annular sleeve 32 is concentrically disposed within the bore 40 of the housing 12 to be positionable about the outer diameter of the tip end portion 16 of the drive shaft 10 to be installed. (Page 8, line 6 through page 9, line 21). The plastic annular sleeve is concentrically disposed to be nominally spaced radially from the outer diameter of the tip end portion 16 of the drive shaft 10, so that the sleeve is operable to supportingly engage the outer diameter of the tip end portion 16 of the drive shaft 10 only in response to radial loads acting to deflect the drive shaft 10 into contact with the annular sleeve 32. (Page 8, line 6 through page 9, line 21). The sleeve 32 is an injection molded sleeve 32 formed in situ within the bore 40 of the housing 12. (Page 9, lines 26-37, and Page 10, line 7 through Page 12, line 1). The annular sleeve 32 has a bore with an inner diameter larger than the outer diameter of the tip end portion 16 of the shaft 10 to be installed. (Page 8, lines 28-35).

A plastic thrust member 34 is disposed within the smaller diameter bore portion 44 of stepped bore 40 of the housing 12 to be in coaxial registry with the end wall 18 of the shaft 10 to be installed. (Page 9, lines 6-21). The plastic thrust

member 34 is operable to be in engagement with the end wall 18 of the drive shaft 10 to be installed to prevent axial movement of the shaft. (Page 9, lines 6-14). The thrust member 34 is an injection molded thrust member 34 formed in situ within the smaller diameter bore portion 44 of the stepped bore 40 of the housing 12. (Page 10, lines 1-6, and Page 11, line 35 through Page 12, line 11). The thrust member 34 is injection molded after installation of the shaft 10, so that a portion of the end wall 18 of the shaft 10 defines at least a portion of a chamber to receive injected plastic forming the thrust member during injection molding. (Page 12, lines 1-11). The outer diameter of the tip end portion 16 of the shaft 10 to be installed is larger than a diameter of the thrust member 34 engagable with the end wall 18 of the tip end portion 16 of the shaft 10. (Page 12, lines 1-11).

ISSUES ON APPEAL

I. Are claims 1-7, 15-18 and 25-28 properly rejected under 35 U.S.C. §112, first and second paragraphs?

These issues are moot in view of the Second After Final Amendment filed with this Appeal Brief eliminating the objected to reference that the shaft is cantilevered, and correcting the antecedent basis for the chamber and the bore by amending claims 1, 6, 8, 12-14, 15, 17-19, 23, 25, and 27 appropriately.

II. Are claims 6-7 unpatentable over Applicant's admitted prior art (AAPA) in view of MacKay et al. (U.S. Patent No. 5,485,044) under 35 U.S.C. §103(a)?

Appellant answers: NO

Examiner answers: YES

III. Are claims 1-2, 4-5, 15-18, and 5-28 properly rejected as being unpatentable over AAPA in view of Oyafuso (U.S. Patent No. 5,144,738) and further in view of MacKay et al. (U.S. Patent No. 5,485,044) under 35 U.S.C. §103(a)?

Appellant answers: NO

Examiner answers: YES

IV. Is claim 3 properly rejected as being unpatentable over AAPA in view of Oyafuso and further in view of MacKay et al., and further in view of Umezawa et al. (U.S. Patent No. 5,218,256) under 35 U.S.C. §103(a)?

Appellant answers: NO

Examiner answers: YES

GROUPING OF CLAIMS

All claims rise and fall independently of one another for the reasons indicated in greater detail below.

ARGUMENT

With respect to the Examiner's rejection of claims 1-7, 15-18, and 25-28 under 35 U.S.C. §112, first paragraph, it is submitted that the application as originally filed includes sufficient disclosure to describe a cantilevered shaft where the shaft is supported at only one end until the shaft is subjected to a radial load of sufficient force to deflect the unsupported end of the cantilevered shaft 10 into contact with the inner diameter of the sleeve 32 which is slightly oversized or larger than the outer diameter of the tip end portion 16 of the shaft 10 as described on page 8, lines 28-31 of the specification as originally filed. This provides a radial spacing

which allows the tip end portion 16 of the shaft 10 to freely rotate within the sleeve 32 without contacting the inner diameter surface of the sleeve 32 during normal operation as described on Page 8, lines 31-35 of the specification as originally filed. When excessive radial forces are exerted on the shaft 10, the tip end portion 16 of the shaft 10 will flex bringing the outer diameter of the tip end portion 16 into engagement with the inner diameter of the sleeve 32 as set forth on Page 8, line 35 through Page 9, line 2 of the specification as originally filed. The sleeve 32 resists further radial movement or deflection of the tip end portion 16 of the shaft 10 so as to support the shaft 10, while reducing noise and friction during rotation of the shaft 10 as described on Page 9, lines 2-5. Therefore, it is clear that the shaft 10 is cantilevered during normal operation, and is deflected into contact with the sleeve 32 when excessive radial forces are exerted on the shaft 10. When deflected into contact with the sleeve 32, it could arguably be stated that the shaft 10 is no longer cantilevered. Therefore, to simplify the issues on appeal, the term cantilevered has been removed in the After Final Amendment filed contemporaneously with this Appeal Brief. Therefore, this issue is considered moot.

With respect to the Examiner's rejection of claims 1-7, 15-18, and 25-28 under 35 U.S.C. §112, second paragraph, it is submitted that the claims have been amended to provide proper antecedent basis for the chamber and the bore and to remove the term cantilevered for the reasons stated in greater detail above. Therefore, these issues are rendered moot for purposes of the present appeal.

Claims 6-7 stand rejected in the Final Office Action under 35 U.S.C. §103(a) as being unpatentable over Applicant's admitted prior art (AAPA) in view of

MacKay et al. (U.S. Patent No. 5,485,044). The Examiner's statement that the AAPA discloses a plastic thrust member operable to be in engagement with the end wall of the shaft to be installed to prevent axial movement of the shaft is without support. A careful reading of the Description of the Art merely indicates that it is known to provide a drilled and tapped bore in the housing axially in line with the worm gear shaft, which bore receives a threaded screw carrying a molded elastomer or resilient end cap as described on Page 2, lines 12-17 as originally filed. The screw is threaded into the tapped bore a sufficient distance to bring the end cap into engagement with the shaft as described on Page 2, lines 17-19. While this minimizes axial movement of the shaft to a certain extent, such an arrangement introduces other problems, the most significant of which is the drilled bore which forms a new water path entry into the motor/gear box housing as described on Page 2, lines 19-24. At present, the Examiner has failed to come forth with any reference which would support the position that the skilled artisan, at the time the invention was made, would have developed a plastic thrust member operable to be in engagement with the end wall of the shaft to be installed to prevent axial movement of the shaft. The original specification of the present application on Page 2, lines 10-25 indicates that axial end play of the gear shaft has been controlled by a threaded screw carrying a molded elastomer or resilient end cap. The screw is threaded into the tapped bore a sufficient distance to bring the end cap into engagement with the shaft. The addition of the MacKay et al. reference does not overcome this deficiency. The MacKay et al. reference teaches an insert 24 preferably made from a brass material as described in Column 3, lines 38-39. At present, the Examiner has failed to come forth with any

reference which would support the position that the skilled artisan, at the time the invention was made, would have developed a plastic thrust member within the bore of the housing disposed to be in coaxial registry with the end wall of the shaft to be installed, and operable to be in engagement with the end wall of the shaft to be installed to prevent axial movement of the shaft. It is submitted that the cited references taken alone or in combination lack objective teaching or indication of knowledge generally available at the time the invention was made that would lead the individual to combine the teachings in a manner which would result in the invention as claimed, (see generally, In re Lintner, 458 F. 2d 1013, 173 USPQ 560 (C.C.P.A. 1972); In re Fielder, 471 F. 2d 640, 176 USPQ 300 (C.C.P.A. 1973); In re Lalu, 747 F. 2d 703, 223 USPQ 1257 (Fed. Cir. 1984); In re Fritch, 972 F. 2d 1260, 23 USPQ 2d 1780 (Fed. Cir. 1992)). It is submitted that the cited references lack sufficient teaching to guide the skilled artisan with respect to the combination or disposition of the various elements of the present invention as claimed. It would appear that some level of skill or knowledge is being assumed or imputed by the Examiner, and the Examiner has not indicated specifically what additional knowledge is imputed to the skilled artisan in order to achieve the combination or disposition of the elements in the claimed invention in the present application. Absent such discussion or the citation of additional references, it is submitted that such knowledge and facts appear to be based, at least in part, on knowledge and information personal to the Examiner or other employees of the United States Patent Office. In order to fully evaluate and respond to the current rejection under 35 U.S.C. §103(a), it is respectfully requested that additional references supporting this rejection should have been made of record.

If additional references cannot be provided, it is requested that the combination of references and the rejection based thereon should have been supported by an affidavit or affidavits by appropriate employees of the United States Patent Office regarding personal knowledge or other citations relied on by the Examiner in advancing this rejection. Without such support, it is submitted that the present rejection is based on an analysis predicated on the supposition that, in view of the cited references, it would have been obvious to try or attempt the combination or disposition of elements which resulted in the present invention. It is submitted that the "obvious to try" standard is inappropriate for supporting a rejection under 35 U.S.C. §103(a), (see generally In re Lindell, 385 F 2d 453, 155 USPQ 521 (C.C.P.A. 1967)). Claim 7 further recites that the thrust member is an injection molded thrust member formed in situ within the bore of the housing. None of the cited references or the Applicant's admitted prior art anticipates, teaches or suggests this specific structural configuration, since none of the cited references anticipate, teach or suggest an in situ, injection molded thrust member formed within the bore of the housing. As such, it is submitted that the Examiner's rejection of claims 6 and 7 is unsupported by the cited references, and reversal of the Examiner's rejection is requested.

With respect to Issue III, claims 1-2, 4-5, 15-18, and 25-18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over AAPA in view of Oyafuso (U.S. Patent No. 5,144,738) and further in view of MacKay et al. (U.S. Patent No. 5,485,044). The Examiner asserts that the Oyafuso patent discloses a plastic annular sleeve within the bore of the housing concentrically disposed to be positionable about the outer diameter of the tip end portion of the shaft to be installed

and to be nominally spaced radially from the outer diameter of the tip end portion. It is submitted that Applicant's admitted prior art discloses machining a bore in the housing to receive a press-in bearing, where the machined bore cannot be held to the necessary tolerance for proper location of the bearing-to-shaft journal essential for low noise and high efficiency of the motor/gear box drive. The addition of the MacKay et al. reference to AAPA does not overcome this deficiency. The MacKay et al. teaches a thrust bearing of brass material, and does not teach or suggest an annular sleeve as recited in the claims of the present application. The addition of the Oyafuso reference does not overcome the deficiency of the combination of AAPA and MacKay et al. In particular, Oyafuso discloses another thrust bearing with adjustable axial and radial movement associated with end play of a rotating shaft. The thrust plug 14 of Oyafuso has a 45 degree tapered inside surface providing a relatively small contact area with tapered tip 13 of shaft 12 during extreme heavy separating forces between gear 16 and worm shaft 15 as described in Column 5, lines 1-4. Oyafuso teaches that the tapered tip 13 contacts the tapered surface of the thrust plug 14 during radial misalignment between the armature shaft 12 and thrust plug 14 as described in Column 5, lines 4-7. None of these three references taken singularly or in any permissible combination, anticipate, teach or suggest, a plastic annular sleeve within the boring of the housing concentrically disposed to be positionable about the outer diameter of the tip end portion of the shaft to be installed and to be nominally spaced radially from the outer diameter of the tip end portion, where the sleeve supportingly engages the outer diameter of the tip end portion of the shaft only in response to radial loads acting to deflect the shaft into contact with the annular

sleeve as recited in claim 1 of the present application. Furthermore, none of the cited references anticipate, teach or suggest, the structural limitation of an in situ, injection molded sleeve formed within the bore of the housing as recited in claim 2. In addition, none of the cited references taken singularly or in any permissible combination anticipate, teach or suggest, the addition of a plastic thrust member within the bore of the housing disposed to be in coaxial registry with the end wall of the shaft to be installed, and operable to be in engagement with the end wall of the shaft to be installed to prevent axial movement of the shaft as recited in claim 4. Furthermore, none of the cited references taken singularly or in any permissible combination anticipate, teach or suggest, an in situ, injection molded thrust member formed within the bore of the housing as recited in claim 5. None of the cited references taken singularly or in any permissible combination anticipate, teach or suggest, the thrust member injection molded after installation of the shaft, where a portion of the end wall of the shaft defines at least a portion of a chamber to receive injected plastic forming the thrust member during injection molding as recited in claim 15. None of the cited references anticipate, teach or suggest the outer diameter of the tip end portion of the shaft to be installed being larger than a diameter of the thrust member engagable with the end wall of the tip end portion of the shaft as recited in claim 16. The combination of AAPA in view of Oyafuso, and further in view of MacKay et al. taken singularly or in any permissible combination do not anticipate, teach or suggest, at least one injection molded plastic annular sleeve formed in situ within the aperture of the peripheral wall and having an inner diameter positionable to encircle the free tip end portion of the shaft to be installed

therethrough with at least some clearance therebetween, such that the annular sleeve is operable to supportingly engage the outer diameter of the free tip end portion of the shaft only in response to radial loads acting to deflect the shaft into contact with the annular sleeve as more specifically recited in claim 17. Furthermore, none of the cited references anticipate, teach or suggest, an injection molded plastic thrust member formed in situ within the at least one aperture of the housing, where the thrust member is disposed to be in coaxial registry with the end wall of the shaft to be installed, and operable to be engagable with the end wall of the shaft to be installed to prevent axial movement of the shaft, where the outer diameter of the free tip end portion of the shaft to be installed is larger than a diameter of the thrust member engagable with the end wall of the free tip portion of the shaft, where the thrust member is injection molded after installation of the shaft, and a portion of the end wall of the shaft defines at least a portion of a chamber to receive injected plastic forming the thrust member during injection molding as recited in claim 18. None of the cited references taken singularly or in any permissible combination anticipate, teach or suggest, the improvement of at least one of a plastic injection molded annular sleeve in a plastic injection molded thrust member formed in situ within the aperture of the housing where the plastic annular sleeve is positionable to be coaxially sheathing the outer diameter of the free tip end portion of the shaft to be installed and to be nominally spaced radially from the outer diameter of the free tip end portion, so that the sleeve is operable to supportingly engage the outer diameter of the free tip end portion of the shaft only in response to radial loads acting to deflect the shaft into contact with the annular sleeve, and where the plastic thrust

member is positionable to be in coaxial registry with the end wall of the shaft, and operable to be engagable with the end wall of the shaft to prevent axial movement of the shaft as recited in claim 25. Furthermore, none of the cited references taken singularly or in any permissible combination, anticipate, teach or suggest, both the plastic injection molded annular sleeve and the plastic injection molded thrust member formed in situ within the aperture of the housing as recited in claim 26. In addition, none of the cited references anticipate, teach or suggest, the bore having a first portion of a first diameter and an axial end most, coaxial, second portion of a smaller diameter, and a shoulder formed between the first and second portions, and a first gate formed in the housing communicating with the first portion as recited in claim 27. None of the cited references taken singularly or in any permissible combination, teach or suggest, a second gate formed in the housing communicating with the second portion as recited in claim 28. In fact, none of the cited references anticipate, teach or suggest, injection molded sleeves or thrust members, and therefore none anticipate, teach or suggest, first and second gates through the housing to permit injection molding as taught and recited in the claims of the present application. At present, the Examiner has failed to come forth with any reference which would support the position that the skilled artisan, at the time the invention was made, would have developed a plastic sleeve member within the bore of the housing concentrically disposed to be positionable about the outer diameter of the tip end portion of the shaft to be installed and to be nominally spaced radially from the outer diameter of the tip end portion. Where the sleeve supportingly engages the outer diameter of the tip end portion of the shaft only in response to radial loads

acting to deflect the shaft into contact with the annular sleeve. It is submitted that the cited references taken alone or in combination lack objective teaching or indication of knowledge generally available at the time the invention was made that would lead the individual to combine the teachings in a manner which would result in the invention as claimed, (see generally, In re Lintner, 458 F. 2d 1013, 173 USPQ 560 (C.C.P.A. 1972); In re Fielder, 471 F. 2d 640, 176 USPQ 300 (C.C.P.A. 1973); In re Lalu, 747 F. 2d 703, 223 USPQ 1257 (Fed. Cir. 1984); In re Fritch, 972 F. 2d 1260, 23 USPQ 2d 1780 (Fed. Cir. 1992)). It is submitted that the cited references lack sufficient teaching to guide the skilled artisan with respect to the combination or disposition of the various elements of the present invention as claimed. It would appear that some level of skill or knowledge is being assumed or imputed by the Examiner, and the Examiner has not indicated specifically what additional knowledge is imputed to the skilled artisan in order to achieve the combination or disposition of the elements of the claimed invention in the present application. Absent such discussion or the citation of additional references, it is submitted that such knowledge and facts appear to be based, at least in part, on knowledge and information personal to the Examiner or other employees of the United States Patent Office. In order to fully evaluate and respond to the current rejection under 35 U.S.C. §103(a), it is respectfully requested that additional references supporting this rejection should have been made of record. If additional references cannot be provided, it is requested that the combination of references and the rejection based thereon should have been supported by an affidavit or affidavits by appropriate employees of the United States Patent Office regarding personal knowledge or other

citations relied on by the Examiner in advancing this rejection. Without such support, it is submitted that the present rejection is based on an analysis predicated on the supposition that, in view of the cited references, it would have been obvious to try or attempt the combination or disposition of elements which resulted in the present invention. It is submitted that the "obvious to try" standard is inappropriate for supporting a rejection under 35 U.S.C. §103(a), (see generally In re Lindell, 385 F 2d 453, 155 USPQ 521 (C.C.P.A. 1967)). Therefore, the Examiner's rejection of claims 1-2, 4-5, 15-18, and 25-28 is unsupported by the cited references, and reversal of the Examiner's rejection is requested.

Claim 3 stands rejected under 35 U.S.C. §103(a) as being unpatentable over the Applicant's admitted prior art in view of Oyafuso, and further in view of MacKay et al., and further in view of Umezawa et al. (U.S. Patent No. 5,218,256). The addition of Umezawa et al. does not overcome the deficiency of the combination of AAPA in view of Oyafuso and further in view of Mackay et al. The Umezawa et al. references discloses a bearing 6 for rotatably supporting a core shaft of a motor core inserted into a bearing seat portion of the motor casing when the temperature of the resin material of the casing which forms the bearing seat portion is substantially at the glass transition temperature or above, so that when the resin is cooled to a room temperature, the bearing seat gradually shrinks to the form of the inserted bearing. None of the cited references taken singularly or in any permissible combination anticipate, teach or suggest, a plastic annular sleeve within the bore of the housing concentrically disposed to be positionable about the outer diameter of the tip end portion of the shaft to be installed and to be nominally spaced radially from

the outer diameter of the tip end portion, where the sleeve is operable to supportingly engage the outer diameter of the tip end portion of the shaft only in response to radial loads acting to deflect the shaft into contact with the annular sleeve, and/or the sleeve having a bore extending therethrough, where the bore has an inner diameter larger than the outer diameter of the tip end portion of the shaft to be installed as recited in claim 3 of the present application. Therefore, the Examiner's rejection of claim 3 is not supported by the cited references, and reversal of the Examiner's rejection is requested.

As set forth in the specification, bearings of the prior art have not been positionable within a motor/gear housing within desired tolerances to support a cantilevered shaft only during deflection of the shaft under radial loads. In the prior art, the bearings supported the shaft continuously resulting in undesired noise and reduced efficiency when not properly aligned. The present invention, on the other hand, teaches a process and apparatus for supporting the free end of a shaft in a motor gear housing only during deflection of the free end of the shaft under radial load. The present invention overcomes the prior art problem of tolerance build-up of the several components in a motor/gear drive including the shaft, the bearing, and the housing of the motor/gear drive by separately injection molding in situ the radial bearing sleeve and the axial thrust bearing. None of the cited references taken singularly, or in any permissible combination, teach or suggest this structure.

At best, the prior art references show components in bits and pieces of the inventive arrangement as claimed in the independent claims while none of the references show an in situ molded sleeve or thrust bearing. The relevant art

recognizes many components and concepts within its domain. Upon close investigation and scrutiny of the diverse practices in this art and its peripheral technical fields of endeavor, a fact-finder is inevitably led to the conclusion that artisans can and could produce a myriad of devices and functions of apparently endless diversity from components and concepts already individually recognized as belonging to the prior art. Such speculation must not cloud the standards for the evaluation of patentability over the prior art under 35 U.S.C. §§ 102 and 103. Properly focused, the issues center on what would have been anticipated, or obvious to one of ordinary skill in the art at the time of the invention. Obviousness is tested by what the combined teaching of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 425, 208 U.S.P.Q. 871, 881 (CCPA 1981). But it cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. See *ACS Hosp. Sys. Inc. v. Montefiore Hosp.*, 732 F.2d 1572, 1577, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984). And teachings of references can be combined only if there is some suggestion or incentive to do so. See *In re Fine*I, 837 F.2d 1071, 5 U.S.P.Q. 2d 1596, 1599 (Fed. Cir. 1988). Approaches to obviousness determinations which focus merely on identifying and tabulating missing elements in hindsight retrospect imbue one of ordinary skill in the art with knowledge of the invention in suit, when no prior art reference or references of record convey or suggest that knowledge, and, fall victim to the insidious effect of hindsight syndrome wherein that which only the inventor taught is used against its teacher. *W. L. Gore & Assoc. v. Garlock, Inc.*t, 721 F.2d 1540, 1553, 220 U.S.P.Q. 312-3 (Fed. Cir. 1983).

One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. *In re Fine*, 5 U.S.P.Q. 2d at 1600.

CONCLUSION

For the reasons stated above, it is respectfully submitted that Appellants' invention as set forth in claims 1-7, 15-18, and 25-28 patentably define over the cited references and is not suggested or rendered obvious thereby. As such, it is respectfully submitted that the Examiner's final rejection of claims 1-7, 15-18, and 25-28 is erroneously based and its reversal is respectfully requested.

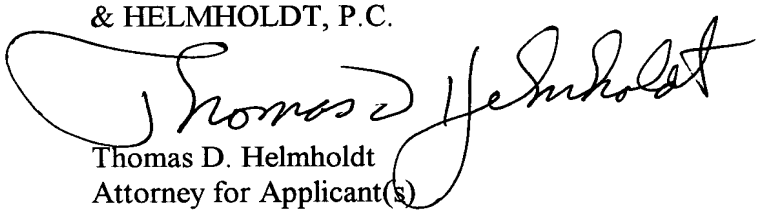
No oral hearing is requested.

Appellants' attorney's check in the amount of $320.00 is enclosed to cover the Appeal Brief filing fee.

This Appeal Brief is being filed in triplicate including one original and two copies.

Respectfully submitted,

YOUNG, BASILE, HANLON, MacFARLANE, WOOD & HELMHOLDT, P.C.



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Dated: April 22, 2002
TDH/cmp

APPENDIX A

1. In a motor/gear drive having a shaft with a worm gear carried thereon and a free tip end portion with an outer diameter terminating in an end wall, and a housing having a bore formed coaxial with respect to the shaft to be installed therein, the improvement comprising:

a plastic annular sleeve within the bore of the housing concentrically disposed to be positionable about the outer diameter of the tip end portion of the shaft to be installed and to be nominally spaced radially from the outer diameter of the tip end portion, and wherein the sleeve is operable to supportingly engage the outer diameter of the tip end portion of the shaft only in response to radial loads acting to deflect the shaft into contact with the annular sleeve.

2. The improvement of claim 1 wherein the sleeve is an injection molded sleeve formed in situ within the bore of the housing.

3. The improvement of claim 1 further comprising:

the sleeve having a bore extending therethrough, the bore having an inner diameter larger than the outer diameter of the tip end portion of the shaft to be installed.

4. The improvement of claim 1 further comprising:

a plastic thrust member within the bore of the housing disposed to be in coaxial registry with the end wall of the shaft to be installed, and operable to be in engagement with the end wall of the shaft to be installed to prevent axial movement of the shaft.

5. The improvement of claim 4 wherein the thrust member is an injection molded thrust member formed in situ within the bore of the housing.

6. In a motor/gear drive having a shaft with a worm gear carried thereon and a free tip end portion with an outer diameter terminating in an end

wall, a housing having a bore formed coaxial with respect to the shaft to be installed therein, the improvement comprising:

a plastic thrust member within the bore of the housing disposed to be in coaxial registry with the end wall of the shaft to be installed, and operable to be in engagement with the end wall of the shaft to be installed to prevent axial movement of the shaft.

7. The improvement of claim 6, wherein the thrust member is an injection molded thrust member formed in situ within the bore of the housing.

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8. A method for manufacturing a motor/gear drive having a shaft with a worm gear carried thereon, and a free tip end portion with an outer diameter terminating in an end wall, and a housing having a bore formed coaxial with respect to the shaft to be installed therein, the method comprising the steps of:

inserting a mold core into the bore of the housing, the mold core having a first end portion with a diameter larger than the outer diameter of the free tip end portion of the shaft and a second larger diameter portion with a shoulder formed between the first and second portions sealingly closing a first portion of the bore in the housing, the first portion of the bore in the housing and the first end portion of the mold core forming an interior cavity therebetween;

injecting molten plastic into the interior cavity through a first gate to form a sleeve having an inner diameter surface surrounding a hollow bore; and

removing the mold core.

9. The method of claim 8 further comprising the steps of:

forming a bearing mounting surface in the housing; and

forming the mold core with a surface engagable with the bearing surface in the housing to concentrically align the mold core and the first bore portion in the housing.

10. The method of claim 8 further comprising the steps of:

forming a first flange on the housing;

forming a second flange on the mold core; and

engaging the first and second flanges to align a longitudinal axis of the mold core with an axis extending through the first portion of the bore in the housing.

11. The method of claim 8 further comprising the steps of:

forming a second gate in the housing communicating with a second portion of the bore in the housing;

forming an end wall of the shaft with an outer diameter larger than the diameter of the second portion of the bore in the housing;

disposing the end wall of the shaft to sealingly close off an end of the second portion of the bore in the housing;

inserting the shaft into the housing with the free tip end portion of the shaft extending through the first portion of the bore in the housing;

disposing the end wall of the shaft to sealing close the second portion of the bore in the housing; and

injecting molten plastic through the second gate into the second portion of the bore in the housing to form a thrust member in the second portion of the bore in the housing in registry with the end wall of the shaft.

12. A method for manufacturing a motor/gear drive having a shaft with a worm gear carried thereon, and a free tip end portion with an outer diameter terminating in an end wall, a housing having a bore formed coaxial with respect to the shaft to be installed therein, the method comprising the steps of:

forming a gate in the housing communicating with one portion of the bore in the housing;

forming the end wall of the shaft with an outer diameter larger than the diameter of the one portion of the bore in the housing;

disposing the end wall of the shaft to sealingly close off an end of the one portion of the bore in the housing;

inserting the shaft into the housing with the free tip end portion of the shaft extending through another portion of the bore in the housing;

disposing the end wall of the shaft to sealing close the one portion of the bore in the housing; and

injecting molten plastic through the gate into the one portion of the bore in the housing to form a thrust member in the one portion of the bore in the housing in registry with the end wall of the shaft.

13. A method for manufacturing a motor/gear drive having a shaft with a worm gear carried thereon, and a free tip end portion with an outer diameter terminating in an end wall, a housing having a bore formed coaxial with respect to the shaft to be installed therein, the method comprising the steps of:

forming the bore of the housing having a first bore portion of a first diameter; and

injection molding a sleeve in the first bore portion, the sleeve having a through bore with an inner diameter larger than the outer diameter of a free tip end portion of the shaft.

14. A method for manufacturing a motor/gear drive having a shaft with a worm gear carried thereon, and a free tip end portion with an outer diameter terminating in an end wall, a housing having a bore formed coaxial with respect to the shaft to be installed therein, the method comprising the steps of:

forming the bore of the housing for receiving the free tip end portion of a shaft; and

injection molding a thrust member within the bore of the housing in registry with the tip end portion of the installed shaft, the thrust member limiting axial movement of the installed shaft.

15. The improvement of claim 5 further comprising:

the thrust member injection molded after installation of the shaft, wherein a portion of the end wall of the shaft defines at least a portion of a chamber to receive injected plastic forming the thrust member during injection molding.

16. The improvement of claim 5 further comprising:

the outer diameter of the tip end portion of the shaft to be installed being larger than a diameter of the thrust member engageable with the end wall of the tip end portion of the shaft.

17. A motor/gear drive housing for enclosing a shaft supporting a worm gear for engagement with a pinion gear, the shaft having one end connectible to a prime mover and a free tip end portion with an outer diameter terminating in an end wall, the motor/gear drive housing comprising:

at least one peripheral wall defining an enclosed area with at least one open side, at least one aperture formed within the peripheral wall and engageable to encircle part of the free tip end portion of the shaft to be installed; and

at least one injection molded plastic annular sleeve formed in situ within the aperture and having an inner diameter positionable to encircle the free tip end portion of the shaft to be installed therethrough with at least some clearance therebetween, such that the annular sleeve is operable to supportingly engage the outer diameter of the free tip end portion of the shaft only in response to radial loads acting to deflect the shaft into contact with the annular sleeve.

18. The motor/gear drive housing of claim 17 further comprising:

an injection molded plastic thrust member formed in situ within the at least one aperture of the housing, the thrust member disposed to be in coaxial registry with the end wall of the shaft to be installed, and operable to be engageable with the end wall of the shaft to be installed to prevent axial movement of the shaft, the outer diameter of the free tip end portion of the shaft

to be installed being larger than a diameter of the thrust member engageable with the end wall of the free tip end portion of the shaft, the thrust member injection molded after installation of the shaft, wherein a portion of the end wall of the shaft defines at least a portion of a chamber to receive injected plastic forming the thrust member during injection molding.

19. In a method for manufacturing a motor/gear drive housing for enclosing a shaft supporting a worm gear for engagement with a pinion gear, the shaft having one end connectible to a prime mover and a free tip end portion with an outer diameter terminating in an end wall, the housing having an aperture formed coaxial with respect to the shaft to be installed therein, the improvement comprising the steps of:

plastic injection molding at least one of an annular sleeve and a thrust member in situ within the aperture of the housing, wherein the plastic annular sleeve is positionable to be coaxially sheathing an outer diameter of the free tip end portion of the shaft to be installed and to be nominally spaced radially from the outer diameter of the free tip end portion of the shaft to be installed, the sleeve operable to supportingly engage the outer diameter of the free tip end portion of the shaft only in response to radial loads acting to deflect the shaft into contact with the annular sleeve, and wherein the plastic thrust member is positionable to be in coaxial registry with the end wall of the shaft, and operable to be engageable with the end wall of the shaft to prevent axial movement of the shaft.

20. The improvement of claim 19 further comprising the steps of:

plastic injection molding both of the annular sleeve and the thrust member in situ within the aperture of the housing.

21. The improvement of claim 19 further comprising the step of:

inserting a mold core into the aperture of the housing prior to injection molding the annular sleeve.

22. The improvement of claim 19 further comprising the step of:

installing the shaft within the aperture in the housing to define at least a portion of a chamber to receive injected plastic prior to injection molding the thrust member.

23. A motor/gear drive housing manufactured according to the method of claim 19 for enclosing a shaft supporting a worm gear for engagement with a pinion gear, the shaft having one end connectible to a prime mover and a free tip end portion with an outer diameter terminating in an end wall, the housing having an aperture formed coaxial with respect to the shaft to be installed therein, the improvement comprising:

at least one of a plastic injection molded annular sleeve and a plastic injection molded thrust member formed in situ within the aperture of the housing, wherein the plastic annular sleeve is positionable to be coaxially sheathing the outer diameter of the free tip end portion of the shaft to be installed and to be nominally spaced radially from the outer diameter of the free tip end portion, the sleeve operable to supportingly engage the outer diameter of the free tip end portion of the shaft only in response to radial loads acting to deflect the shaft into contact with the annular sleeve, and wherein the plastic thrust member is positionable to be in coaxial registry with the end wall of the shaft, and operable to be engageable with the end wall of the shaft to prevent axial movement of the shaft.

24. The improvement of claim 23 further comprising:

both of the plastic injection molded annular sleeve and the plastic injection molded thrust member formed in situ within the aperture of the housing.

25. In a motor/gear drive housing for enclosing a shaft supporting a worm gear for engagement with a pinion gear, the shaft having one end connectible to a prime mover and a free tip end portion with an outer diameter

terminating in an end wall, the housing having an aperture formed coaxial with respect to the shaft to be installed therein, the improvement comprising:

at least one of a plastic injection molded annular sleeve and a plastic injection molded thrust member formed in situ within the aperture of the housing, wherein the plastic annular sleeve is positionable to be coaxially sheathing the outer diameter of the free tip end portion of the shaft to be installed and to be nominally spaced radially from the outer diameter of the free tip end portion, the sleeve operable to supportingly engage the outer diameter of the free tip end portion of the shaft only in response to radial loads acting to deflect the shaft into contact with the annular sleeve, and wherein the plastic thrust member is positionable to be in coaxial registry with the end wall of the shaft, and operable to be engageable with the end wall of the shaft to prevent axial movement of the shaft.

26. The improvement of claim 25 further comprising:

both of the plastic injection molded annular sleeve and the plastic injection molded thrust member formed in situ within the aperture of the housing.

27. The improvement of claim 1 further comprising:

the bore [aperture] having a first portion of a first diameter and an axially endmost, coaxial, second portion of a smaller diameter, a shoulder formed between the first and second portions, and a first gate formed in the housing communicating with the first portion.

28. The improvement of claim 27 further comprising:

a second gate formed in the housing communicating with the second portion.